



Dr. J. Lederberg
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31st March, 1981

Dear Dr. Lederberg,

Thank you for your letter and enquiry, and enclosures. The reported failure of the VENUS probe was due to a comma replaced by a dot in a DO statement.

$D010I = 1,23$ becomes $D010I1 = 1.23$

where $D010I1$ is automatically declared as a new variable in FORTRAN.

I do not think this particular problem will arise in ADA; but worse ones will. An obvious problem will be errors in the compiler. Experience with PL/I shows that in the early years, there are at all times perhaps a hundred known errors (as yet uncorrected). Any single error can have a disastrous effect. The second problem is the complexity of the language. The only way of detecting a problem like your sign inversion error is for meticulous physicists to carefully read the text of the program. But the language has so many features and interactions that even professional programmers cannot understand it: if a physicist thinks he understands it, he is almost certainly wrong - and again the results could be devastating.

Finally, features like exception handling are extremely dangerous. When an unplanned error occurs, ADA gives ample assistance in analysing its symptoms, which is absurd. Any programmer who uses exceptions deliberately is never going to be able to distinguish deliberate (planned) overflows from those which are in principle unplannable - e.g. alpha particles or compiler bugs. He is using his fire alarms as a front door bell, and writing programs that will start to identify the visitor, even when a real fire breaks out. How could anything so silly be put into a programming language? Well, there are historical, political, and sociological reasons, which I will not go into.

Yours sincerely,

A handwritten signature in dark ink that reads "C. A. R. Hoare". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

C.A.R. HOARE
Professor of Computation
Oxford University